



MicroCSP: Generation, Heating, Cooling

C3P and NASA “Enhancing Mission through Proactive
Environmental Risk Mitigation Conference”
San Diego, California

November 19th, 2008

1. Technology: CSP vs. MicroCSP
2. Solar Tutorial
3. Summary



Technology vs. Products

Edison & The Light Bulb

“Edison did not invent the first electric light bulb, but instead invented the first **commercially practical** incandescent light.”

Wikipedia “Thomas Edison”



1879



< 20% efficient



80% efficient

1999



People Don't Buy Technology

People don't buy technology, they buy Products that are **commercially practical**

Commercial

- Available to the Public
- Installers Available/Qualified
- Service/Maintenance On-going
- Meets State/Federal Regulations

Practical

- Cost Effective
- Safe to Use
- Small Enough to Fit Space
- Better Than Alternatives

MicroCSP, the CFL of Solar Market



Utility-scale Desert Applications



Smaller Industrial Applications



Market Differentiation

Sopogy's MicroCSP focuses on distributed generation markets. Traditional CSP providers focus on utility deployments

Distributed Generation

- 250kW – 20MW & thermal
- Customer sited



Utility Scale Parabolic Trough

- 64MW – 500MW+
- Desert deployments



Other Technologies

- 100MW+
- Desert Deployments



Source: Emerging Energy Research

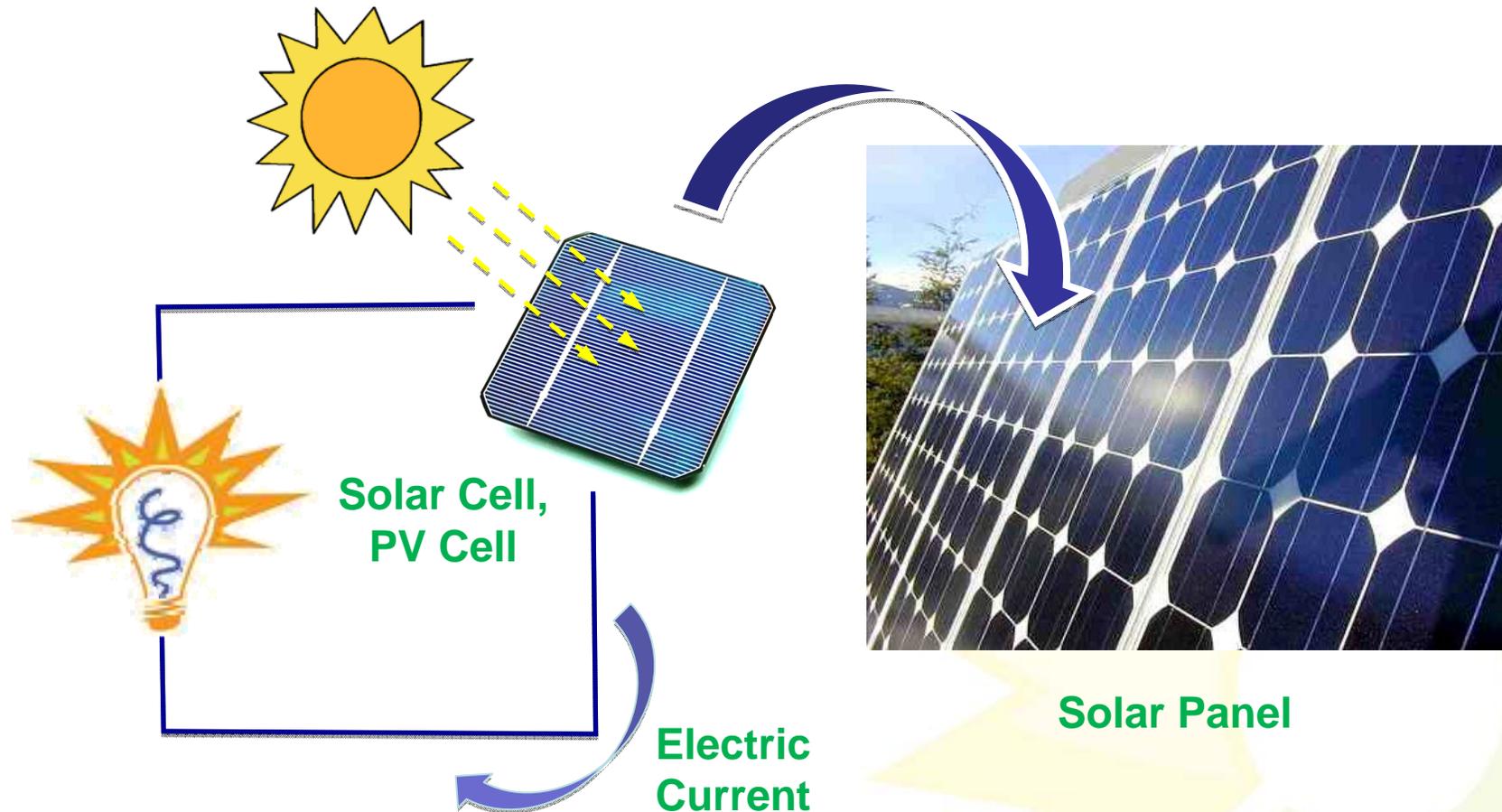
Utility Grade Central Receiver

- 25MW – 100MW+
- Desert Deployments



A Quick Solar Tutorial

- PhotoVoltaic Solar (PV, Cells, Modules, Panels)
- What most people think of when they hear “SOLAR”



PV Infrastructure is \$\$\$

- Challenges are in production costs and materials costs
- Cleanrooms \$\$\$, Si/Cd/Cu/Te/Ga/As \$\$\$



Image: RPA



Image: NASA



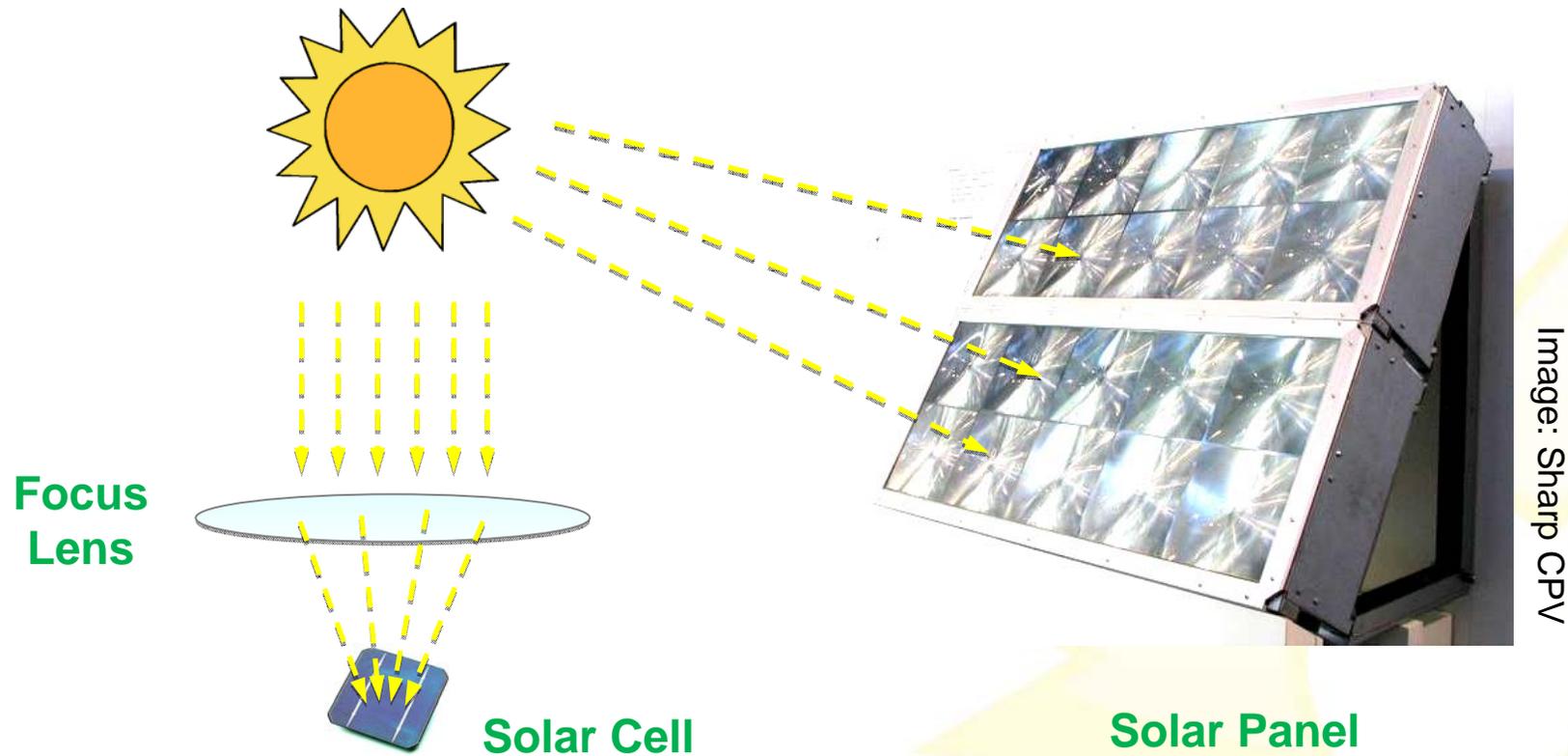
Image: TUB



Image: Intel

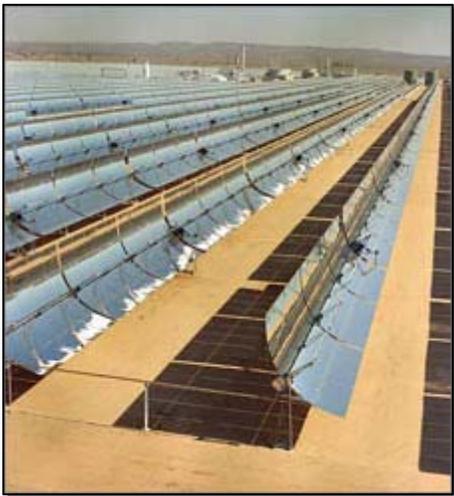
CPV Tries To Use Less Material

- Concentrated Photovoltaic Solar (CPV)
- Concentrating 500 “Suns” unto a Solar Cell
- The idea is to use less solar cell material to reduce \$\$



Concentrating Solar Power (CSP)

- Concentrating Solar Power (CSP)
- Concentrating Solar Thermal
- Solar Thermal Energy



Trough

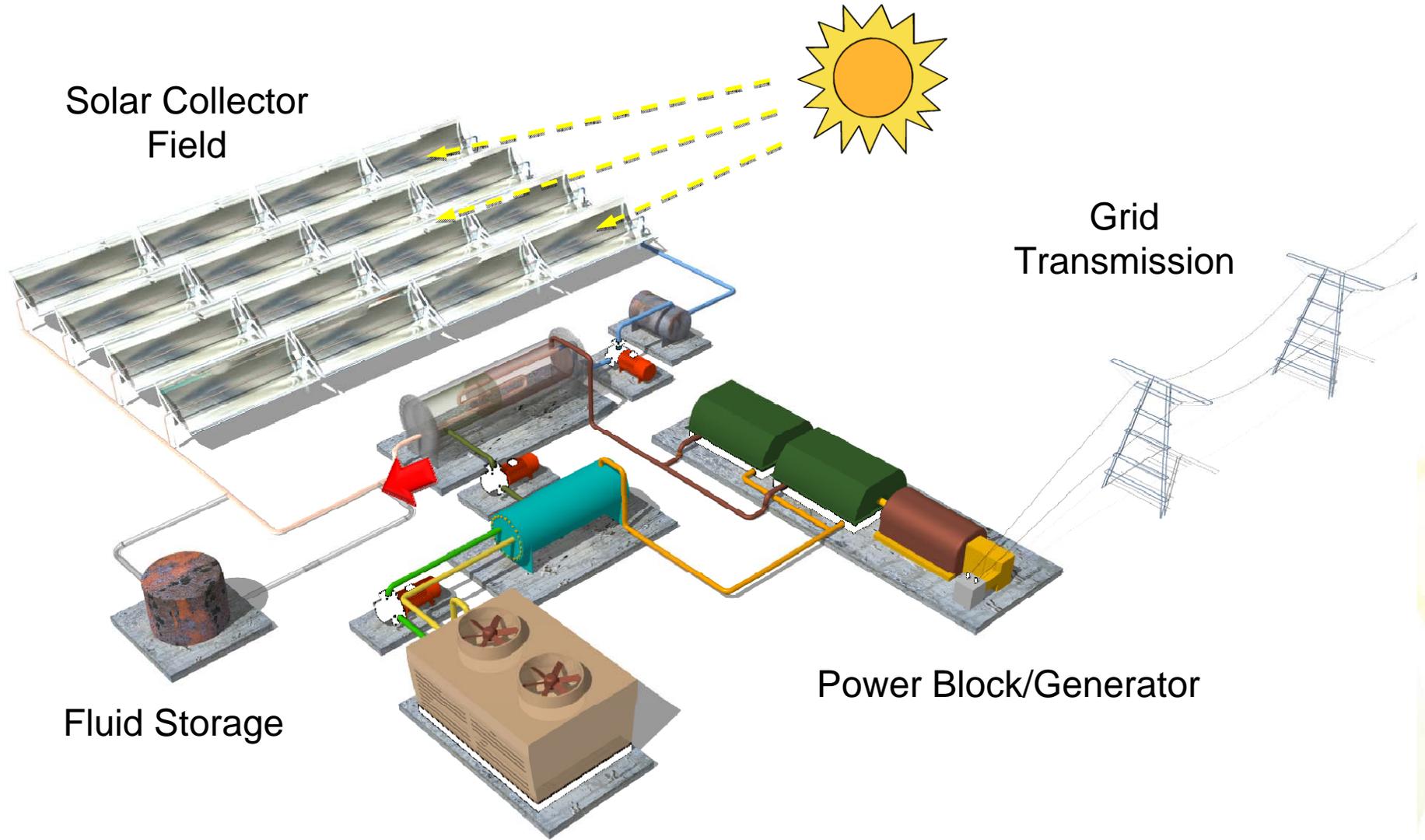


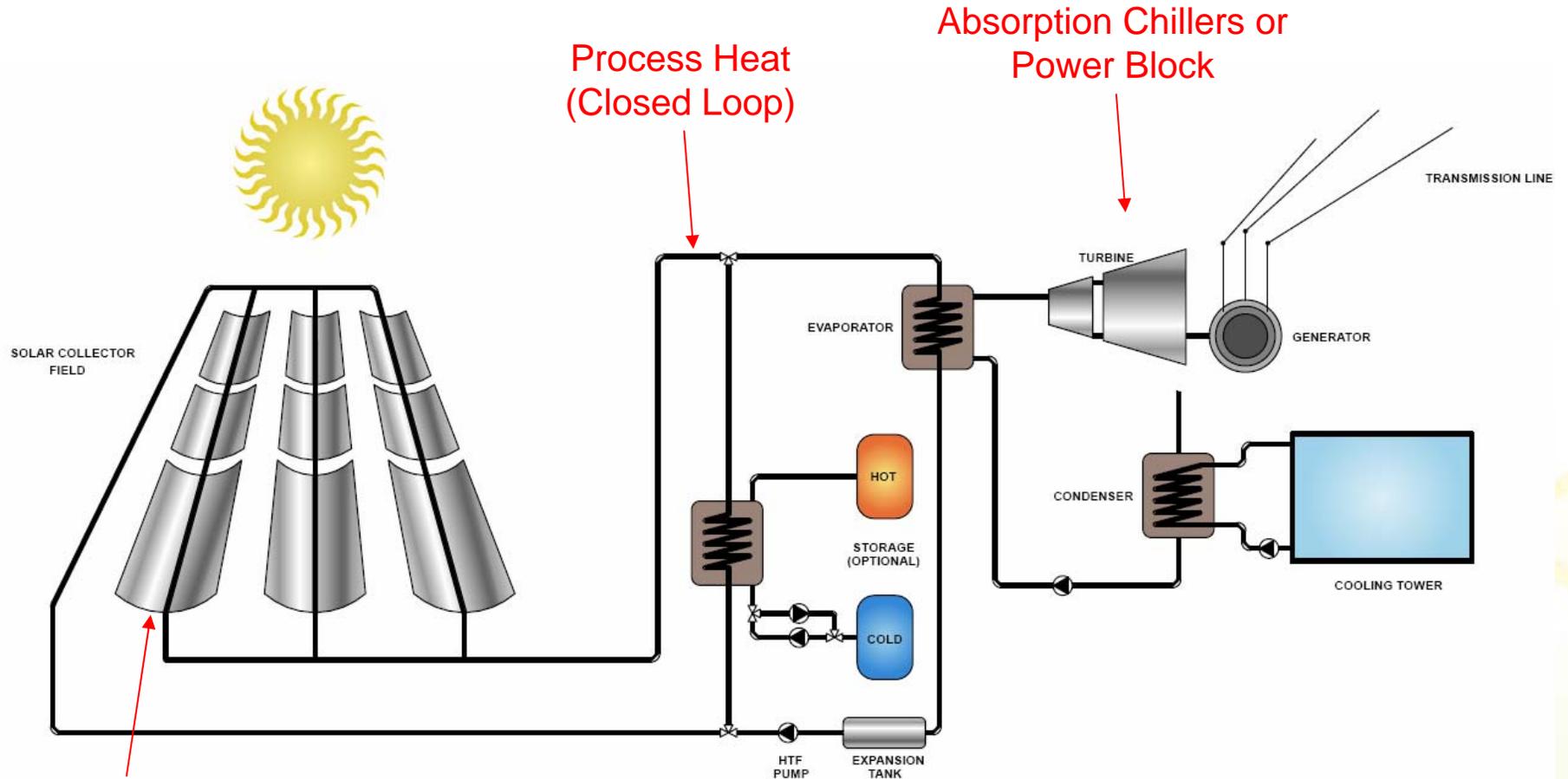
Dish



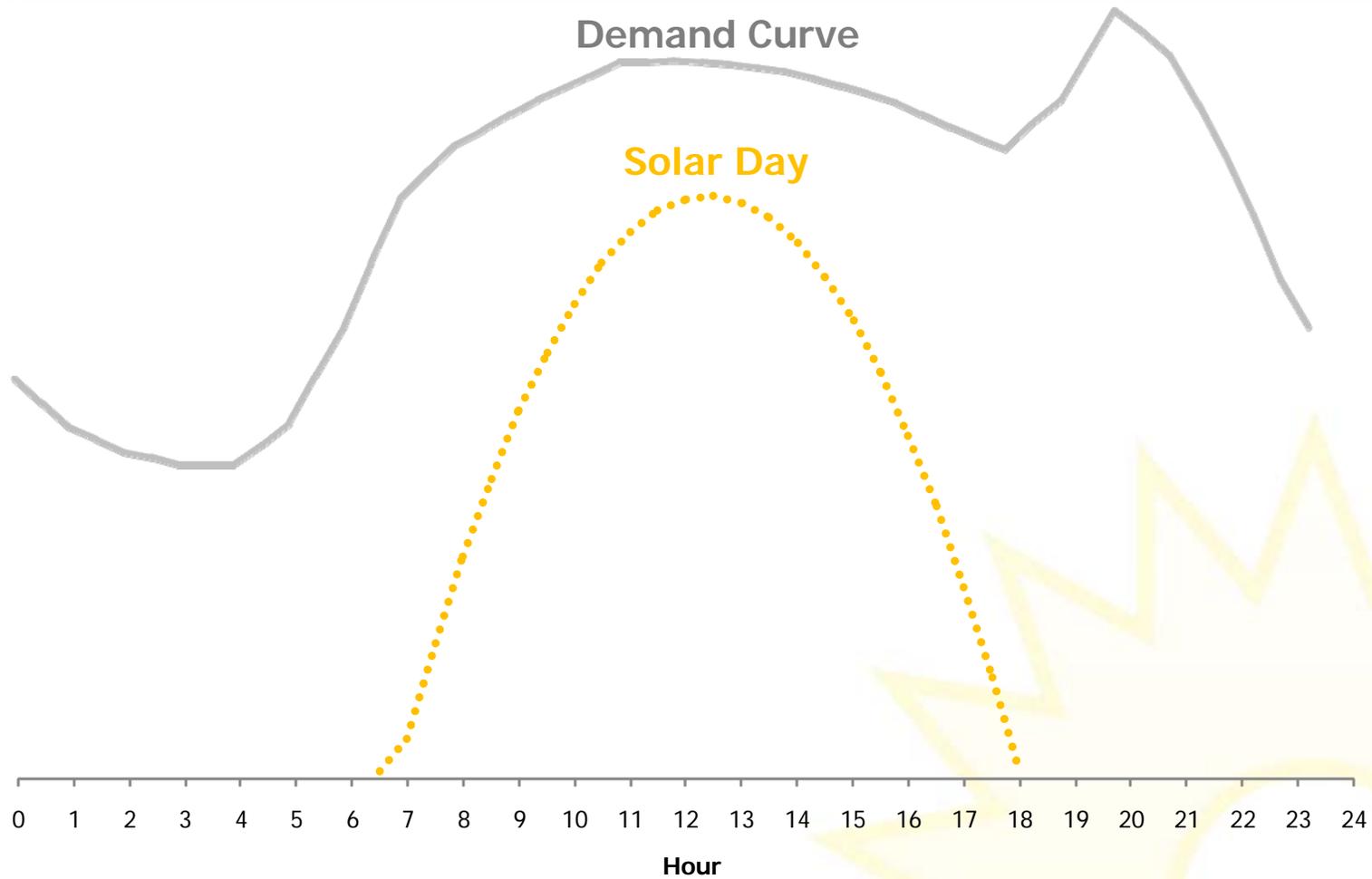
Tower

Concentrated Solar Power (CSP)

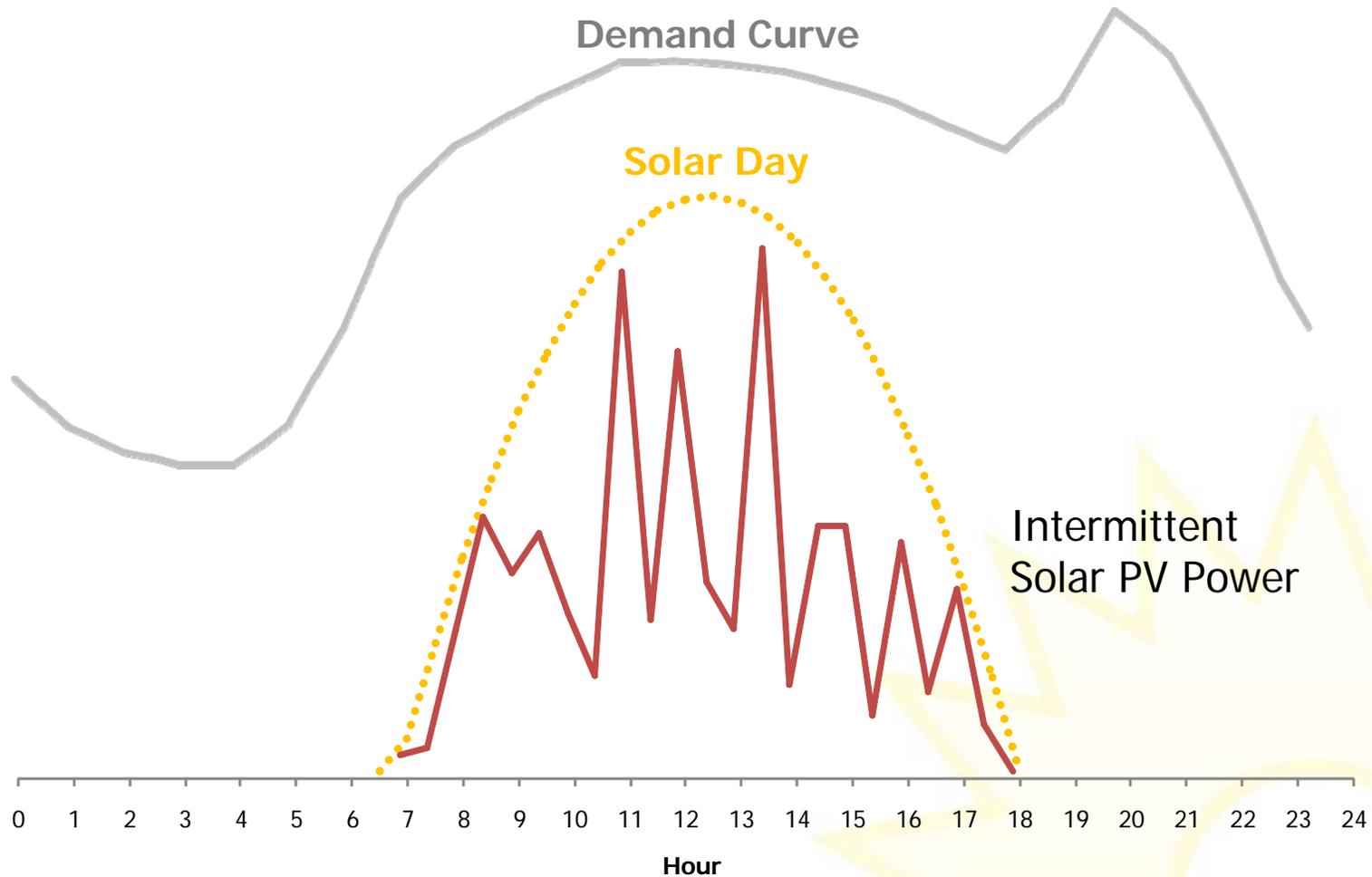




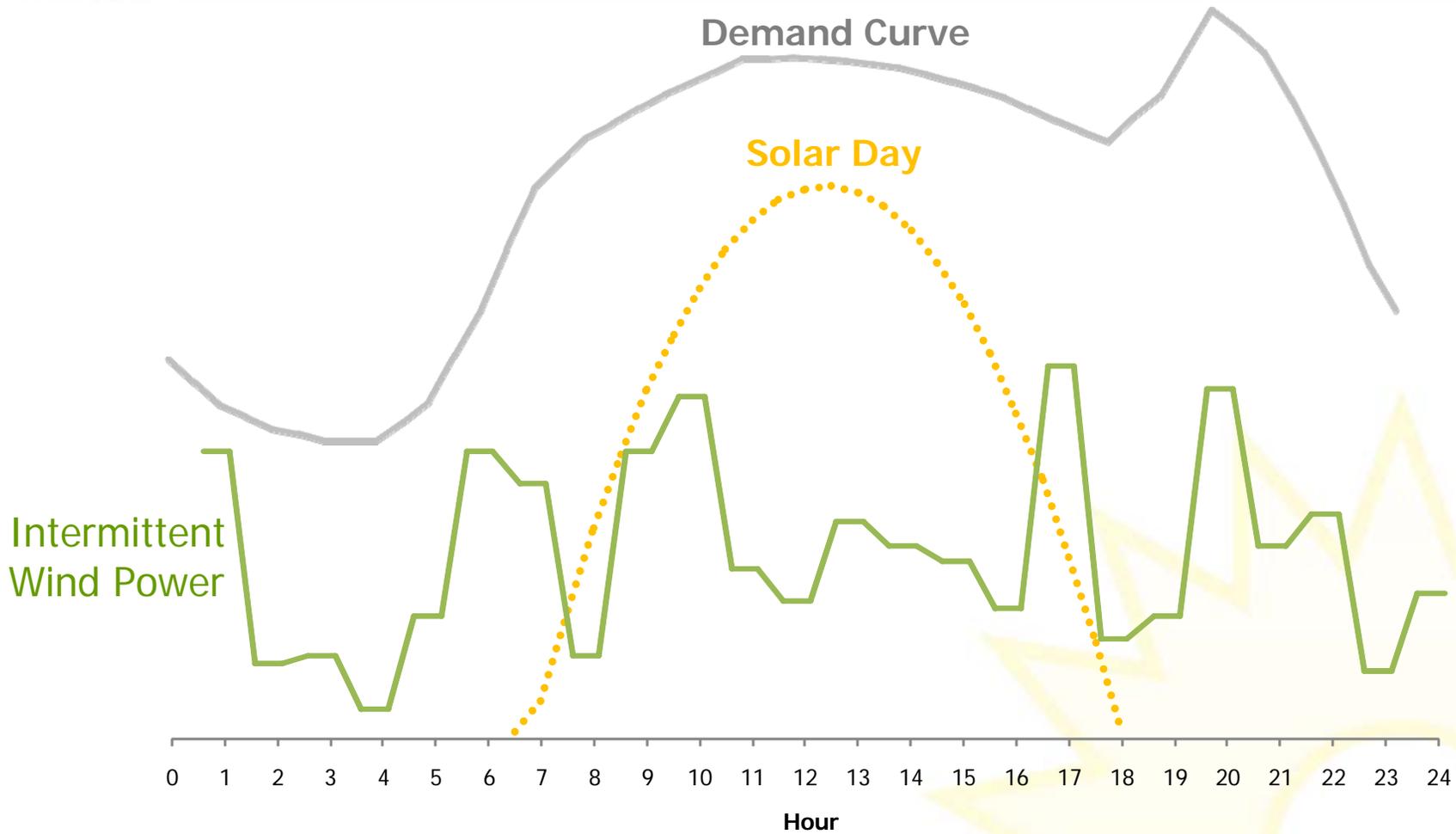
Sopogy SopoNova 4.0
Collectors, Trackers,
Stands, Controls



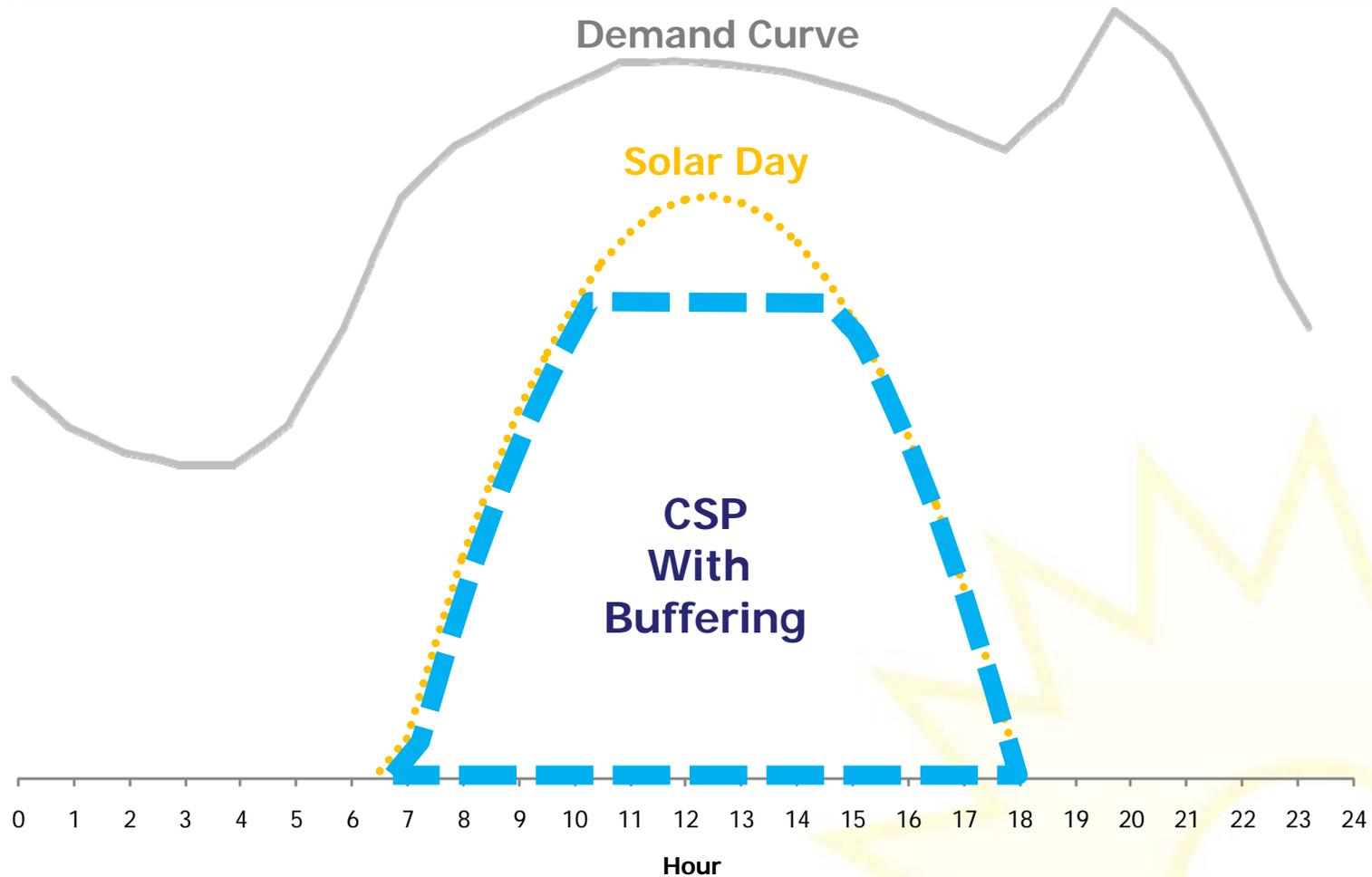
MicroCSP Matches Customer Needs



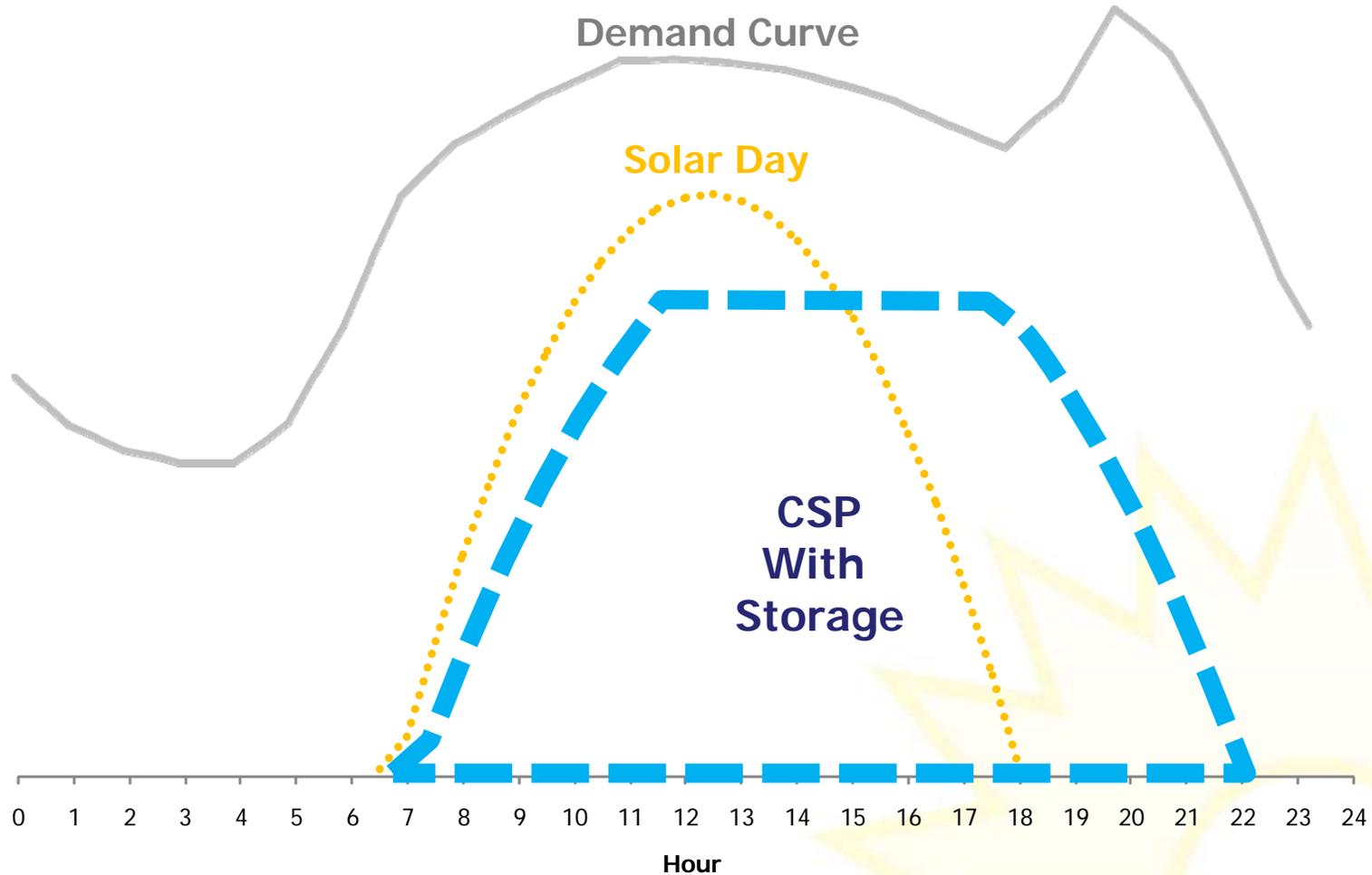
MicroCSP Matches Customer Needs



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MicroCSP Matches Customer Needs

Introducing MicroCSP To The World

Conventional CSP Challenges

Description

- Conventional CSP:
 - Generally 100 MW +
 - Smaller demos exist
 - Power generation
 - Organic Rankine Cycle Power (ORC)

Long Lead Times

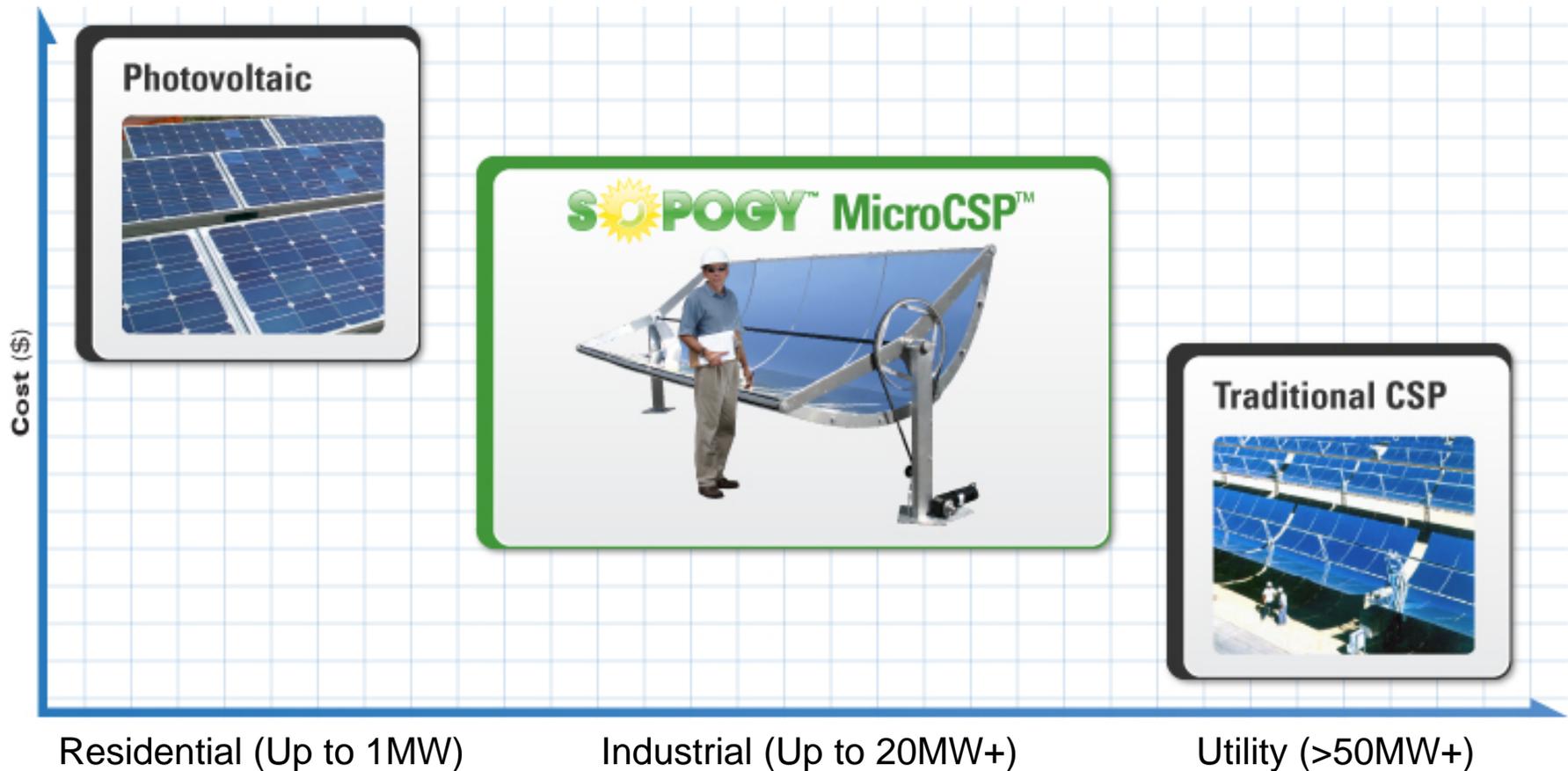
- Large land parcels > EIS = Time
- Transmission Access = Time
 - Queues, grid capacity, FERC
- Equip. supply constraints = Time
 - ORC power blocks

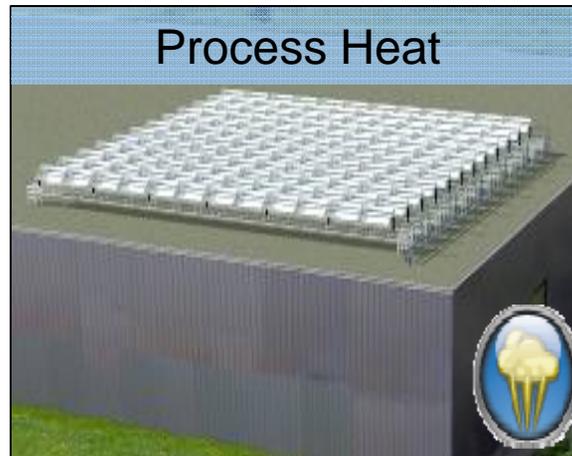
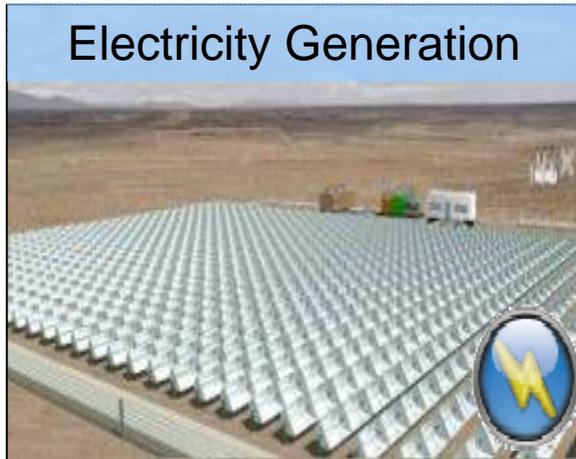


Utility deployments for the desert

MicroCSP™ is a scalable solution for industrial/commercial applications

- PV fits smaller residential and small industrial applications
- Traditional CSP comes in above 50MW++





Electric:
20% efficiency



Process Heating:
60% efficiency



Air Conditioning:
25% efficiency



Market Differentiation

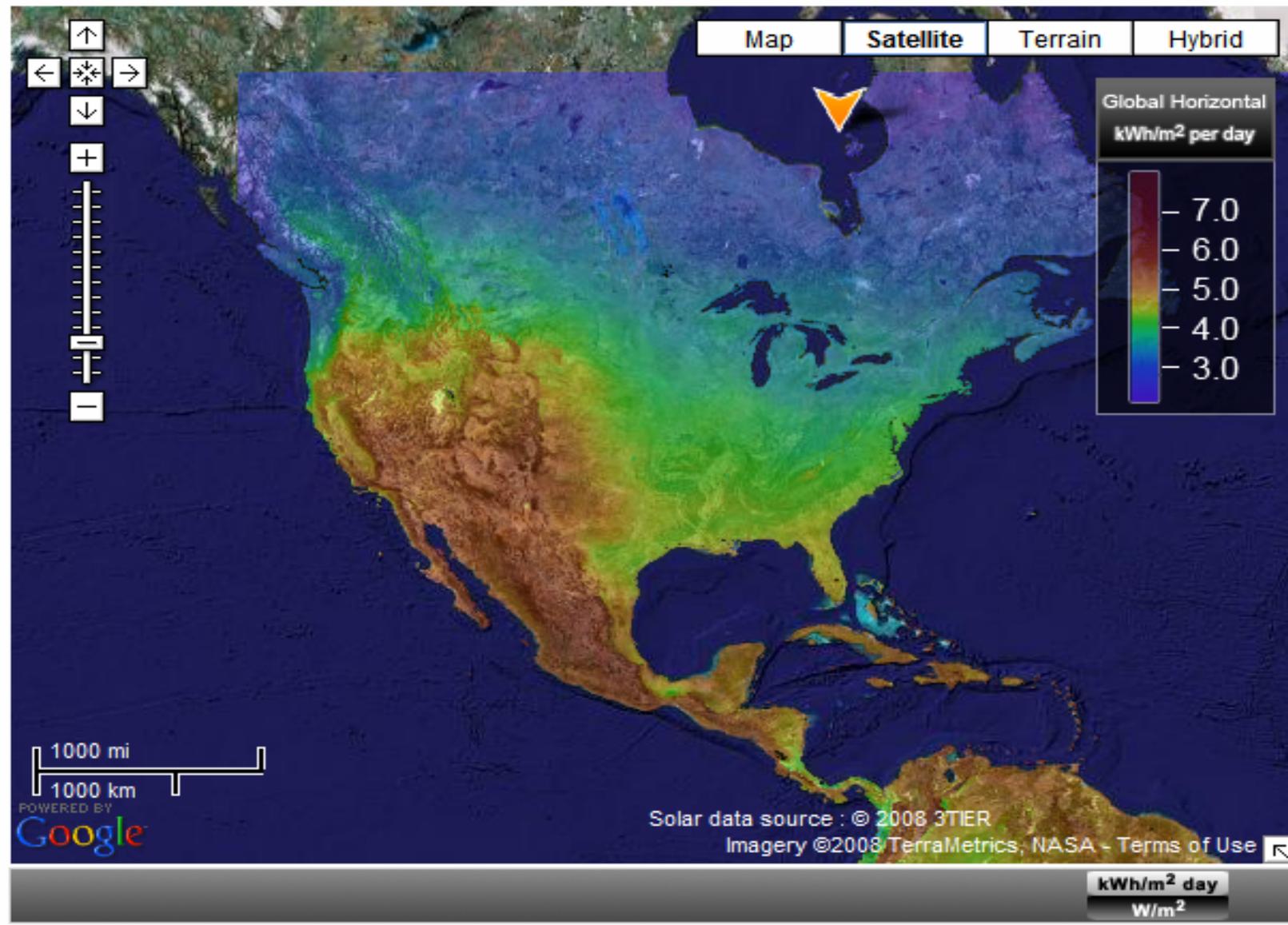
- Smaller projects: 1 to 20 MW
- Shorter project lead times
 - 9 to 12 months
- 3 primary applications
 - Power: Distributed generation
 - Air Conditioning: thermally driven, absorption (or adsorption) A/C
 - Process Heat: industrial, food processing, low grade steam
- Power/DG: Access to grid at distribution voltages
- Utilize local resources



Keahole Solar Power 500kW



Solar Resource Map



Source: <http://firstlook.3tiergroup.com/solar/>

Thank You – Questions?



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